Eastern range extension of *Pseudomys hermannsburgensis* in Queensland

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Introduction

The Sandy Inland Mouse *Pseudomys hermannsburgensis* and the Delicate Mouse *P. delicatulus* are two closely allied members of the largest genus of Australian rodents (Watts and Aslin 1981). Currently 22 species are recognised in the genus *Pseudomys* (Cole and Woinarski in press), though the taxonomy of this large group has variably been considered "a repository for species hard to classify" (Watts and Aslin 1981). Taxonomic reassessment of the group is ongoing (Breed and Aplin 1995; Breed 1996; F. Ford, pers. comm. 2002, James Cook University).

Pseudomys hermannsburgensis and *P. delicatulus* occur widely in Australia in sparsely grassed open woodlands, shrublands, *Triodia* grasslands and sand-plains, with *P. hermannsburgensis* more typical in treeless environments. Both are small to intermediate sized (6-18 g, 55-90 mm) burrowing rodents, *P. hermannsburgensis* being slightly larger (Cole and Woinarski in press). *Pseudomys delicatulus* is widely distributed in eastern Queensland, and though *P. hermannsburgensis* is widespread in central Australia, it has only recently been confirmed as occurring in Queensland, despite long-held expectations of its presence (Covacevich and Easton 1974). Specimens collected in 1936 near Longreach and identified as *P. minnie flavescens* (*P. australis*) have been recently reassigned as *P. hermannsburgensis* (S. Van Dyck, pers. comm. 2001, Queensland Museum) and the species has been captured frequently in long-term studies in southwest Queensland (Murray *et al.* 1999; Dickman *et al.* 1999).

The two species were considered to be mutually exclusive in distribution, with *P. delicatulus* noted to have an almost perfect Torresian occurrence (Braithwaite and Covacevich 1995), with *P. hermannsburgensis* Eyrean by default. They are morphologically similar, and considered difficult to distinguish on external characteristics (Cooper 1993). Some workers have suggested distribution alone as an appropriate surrogate for identification (Covacevich and Easton 1974; Watts and Aslin 1981). Both species derived from a common ancestral *Pseudomys* form entering from New Guinea between 5-10 million years ago, with the subsequent evolution of *P. hermannsburgensis* into an inland species during a period of Pleistocene aridity and divergence (Baverstock 1982). *Pseudomys delicatulus*, *P. novaehollandiae* and *P. hermannsburgensis* are all closely related (Baverstock *et al.* 1981).

Despite earlier contentions of the exclusive distribution patterns of these two species, evidence exists for sympatry between *P. hermannsburgensis* and *P. delicatulus* in Western Australia (How *et al.* 1991) and the Northern Territory (J. Cole pers. comm. 2002, Northern Territory Department of Infrastructure, Planning and Environment). In Western Australia, both were trapped together in three sites at the Abydos-Woodstock Reserve, in very low open *Eucalyptus* and *Acacia* woodland, with *Triodia* spp. ground cover and sandy soils (How *et al.* 1991). In the Northern Territory distributions overlap in a band about 180 km wide. They are sympatric in the Mitchell Grass Downs Bioregion (*Astrebla pectinata* grasslands), and within 5 km of each other in the Gulf Fall Uplands Bioregion (*Eucalytus leucophloia* low open woodland with *Trioda* sp.) and in the Tanami Bioregion (mixed *Triodia/Plectrachne* spp. grasslands) (J. Cole pers. comm. 2002, Northern Territory Department of Infrastructure, Planning and Environment). This note reports on the opportunistic capture of *P. hermannsburgensis* in Queensland, identifying an eastern range extension and possible areas of overlap with *P. delicatulus*.

Study area and methods

New localities for *P. hermannsburgensis* for Queensland were obtained from three fauna surveys (Fig. 1). Firstly during a broad-scale vertebrate fauna survey undertaken in the Desert Uplands bioregion in central-north Queensland between 1997 and 2000, two records of *P. hermannsburgensis* were collected via systematic cat gut sampling (ASK unpubl. data) (Fig. 1). Both of the localities are entirely encompassed by the distribution of *P. delicatulus* and *P. desertor*, the two most common and widespread native species throughout the Desert Uplands and adjacent Northern Brigalow Belt (ASK unpubl. data). This region has a typical dry tropical savanna climate, with rainfall between 500-750 mm. The Desert Uplands and Northern Brigalow Belt study areas, and the quadrat and feral cat gut sampling techniques are described in further detail in Kutt *et al.* (2002) and Kutt (2002a, b).

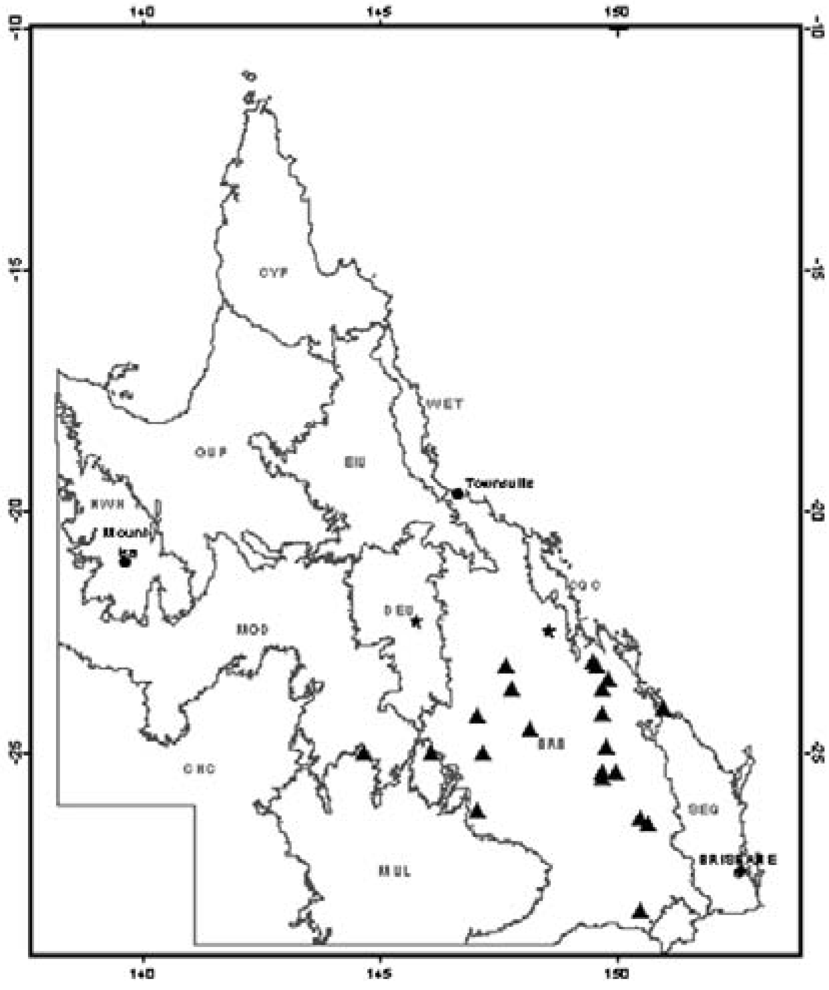

Figure 1. Distribution of *P. delicatulus* (●) and *P. hermannsburgensis* (▲), using data from the Queensland Museum and the Desert Uplands survey (ASK unpubl. data). Location of new *P. hermannsburgensis* records in area of potential sympatry with *P. delicatulus* indicated by (★). CYP=Cape York Peninsula, GUP=Gulf Plains, WET=Wet Tropics, NWH=North-west Highlands, MGD=Mitchell Grass Downs, DEU=Desert Uplands, BRB=Brigalow Belt, CHC=Channel Country, MUL=Mulga Lands, CQC=Central Queensland Coast, SEQ=South-east Queensland

The second location derives from results of long-term terrestrial fauna monitoring using pitfall traps at Culgoa Floodplain National Park, (CE unpubl. data) which lies at the confluence of the Mulga Lands and Southern Brigalow Belt/Darling Riverine Plains Bioregions, 170 km south-west of St. George. Predominant landforms at Culgoa are clay plains vegetated by mixed *Eucalyptus coolabah*, *E. largiflorens*, *Acacia harpophylla* and *A. cambagei* woodlands, *A. aneura* communities on massive red earths, and low sand ridges dominated by *Callitris glaucophylla*. This survey aims to inventory the vertebrate fauna and habitat relationships within the park, and was commenced in 1996. Sampling sites consist of a pitfall line of eight buckets joined by a linear drift fence 30-40 m in length. A total of 23 from 43 sites have been sampled to date. Three animals were collected at Culgoa, a typical semi-arid environment with rainfall between 250-500 mm.

Finally records of *P. hermannsburgensis* were obtained during a fauna survey of Rosscoe Downs (RJ unpubl. data), a sheep-cattle property about 100km southeast of Cunnamulla in the semi-arid Mulga Lands. This survey was conducted as part of a nature conservation extension project, and comprised of six sites (consisting of a single pitfall line of five buckets joined by 30 m of drift fence), sampled over four nights on two visits. The vegetation of the property is predominantly mixed *Eucalyptus* and *Acacia* woodland on alluvial plains interspersed with *Callitris glaucophylla* and *A. aneura* on sandy dune ridges. The climate here is also semi-arid.

The location of these *P. hermannsburgensis* records are firstly of note being substantially east of other known specimens found in the Channel Country and Mitchell Grass Downs Bioregions. Secondly, and in particular regards to the Desert Uplands records, they suggest a zone of potential overlap in the distribution of *P. delicatulus* and *P. hermannsburgensis* in Queensland. Though the Desert Uplands records are definitive, their derivation from cat gut samples means it is impossible to identify the exact location and habitat where the *P. hermannsburgensis* prey items were taken. Conversely specific habitat data are available for the live captured animals.

Locality descriptions

Summerdell Station, 23° 45.6’S 146° 3’E

A single animal was collected from the gut of a tabby adult male feral cat shot on 14 July 1998 (Queensland Museum no. JM 13662). The vegetation at this site consists predominantly of open-woodlands of *Eucalyptus populnea*, *E. melanophloia* and *E. similis* with ground cover of tussock and hummock grasses on a range of alluvial, sandy earths and texture contrast soils.

Hobartville Station, 23° 15’S, 146° 24.6’E

A *Pseudomys hermannsburgensis* hair sample, (B. Triggs, pers. comm. 2001, “Dead Finish”) and a *P. delicatulus* (Queensland Museum no. JM 13628) were collected from the gut of a blotched adult male feral cat shot on 18 July 1998. The vegetation at this site consists predominantly of open-woodlands of *Eucalyptus populnea*, *E. melanophloia*, *Corymbia dallachiana* and *C. plena* with ground cover of tussock and hummock grasses on a range of alluvial, sandy earths and texture contrast soils. Sandstone escarpments with patches of *Acacia shirleyi*, *A. catenulata* and *E. similis* are interspersed.

Though the identification of *P. hermannsburgensis* at Hobartville was considered “definite” against examples held in a voucher library (B. Triggs, pers. comm., 2001, “Dead Finish”, Genoa), it is recognised that a whole animal would be required to confirm this locality. Only the identification of *Pseudomys fumeus* by hair morphology has been reported as reliable in Victoria (Lobert *et al.* 2001), and no other published data exists for other *Pseudomys* species. The veracity of using hair identifications as definitive species records has been discussed further in Kutt (2002b). However the presence of a whole animal in a cat gut in an adjacent property (Summerdell), with continuous and identical vegetation types suggests that the presence of *P. hermannsburgensis*, at least parapatric with *P. delicatulus* at Hobartville, is possible.

Culgoa Floodplain National Park, Byra section 28°54’14”S, 147°07’1E”E

A single adult male was caught in a pitfall trap on 27 November 1997 and collected as a voucher specimen (Queensland Museum no. JM 12644). Vegetation at the site consists predominantly of *Eucalyptus largiflorens* open woodland with a very sparse mid-layer composed of *Eremophila deserti* and ground cover dominated by chenopods and forbs. The site is a seasonally flooded alluvial plain with deep grey cracking clay.

Culgoa Floodplain National Park, East Burrenbah Section, 28°49’15”S, 146°47’20”E

One adult male was caught in a pitfall trap on 21 December 1999 and collected as a voucher specimen (Queensland Museum no. JM14797). The vegetation at this site consists of mixed *Acacia harpophylla, Eucalyptus coolabah* open woodland with a mid-layer composed of *Muehlenbeckia florulenta*, *Eremophila maculata*, *Chenopodium auricomum* and other chenopods, and a ground cover dominated by *Eragrostis setifolia*, with occasional *Astrebla lappacea* and other grasses and forbs. The site is a seasonally flooded alluvial plain with deep grey cracking clay soils. A second adult male was caught and released at an adjacent pitfall site (28º51’18”S, 146º49’00”E) on 18 December 1999. The landform and vegetation is similar to that described above.

Rosscoe Downs Station 28°34’30”S, 146°33’19”E

Three individuals were caught between 28-30 March 1999, and one further individual between 6-8 July 1999, all in pitfall traps. The sex of each was unrecorded though one individual lodged with the Queensland Museum as a voucher (JM 13229). The vegetation at this site consisted of low open woodland of *Callitris glaucophylla*, *Acacia excelsa*, *Geijera parviflora* with occasional *Acacia aneura*, a mid-layer dominated by *Dodonaea viscosa* subsp. *angustissima* and ground cover of sparse to mid-dense *Aristida contorta*. The land type consists of an old alluvial dune with deep red sand.

Discussion

The locations of the *P. hermannsburgensis* reported here extend to the east the known range of this species in Queensland. The proximity of these records to known localities of *P. delicatulus* suggests a broad zone of parapatry occurs, and potentially containing habitat where the two species co-occur. In the Desert Uplands survey, and a contemporary survey of the southern Desert Uplands/adjacent Northern Brigalow Belt woodlands (Hannah and Thurgate 2001), no *P. hermannsburgensis* were trapped in over 563 separate quadrat samples with a composite total of over 29000 Elliott trap-nights and 7500 pit-trap nights. This is despite the reported localities here being central to the combined study areas. A number of *Pseudomys* specimens were collected for museum verification across the range of sites and all were identified as *P. delicatulus*, though as many more animals were captured than collected, it is possible some *P. hermannsburgensis* could have been overlooked. For comparison, at Culgoa over 4000 pit trap nights have only resulted in the capture of three *P. hermannsburgensis*. Low abundance, scattered distribution and rarity are a common pattern for species on the edge of their typical range (Brown and Lomolino 1998). Regardless, *P. hermannsburgensis* in central Australia is an uncommon and irruptive species, populations often responding only to high rainfall (Dickman *et al.* 1999).

The location of *P. hermannsburgensis* at Culgoa Floodplain National Park and Rosscoe Downs Station was perhaps predictable given the occurrence of this species in contiguous areas of the Culgoa floodplain in New South Wales (Dick and Andrew 1993; Dickman 1993). However, the extent and abundance of *P. hermannsburgensis* and other *Pseudomys* throughout the Mulga Lands, the Southern Brigalow Belt and in areas adjacent to Culgoa Floodplain NP is poorly known. *Pseudomys delicatulus* has been recorded at Chesterton Range NP in the northeast of the Mulga Lands bioregion continuous with a population in Carnarvon NP (C. Dollery pers. comm. QPWS), and at Thrushton NP in the Mulga Lands bioregion to the northwest of Culgoa (CE unpubl. data). These records lie on a line of longitude (between 146-147°E) equivalent to the Desert Uplands records. Therefore it is proposed that this area is a broad zone of potential overlap between *P. hermannsburgensis* and *P. delicatulus*, a situation similar to the distribution of the two species in the Northern Territory.

It was once considered that sympatry in *Pseudomys* occurred only in central Australian deserts (Watts and Aslin 1981; Morton *et al.* 1994). Recent work suggests that *Pseudomys* species commonly co-occur but are divided by seral and microhabitat differences (e.g. Dickman *et al.* 1999). Within a broad geographic band coincident with the Great Dividing Range in Queensland, a high number of allied rodent species occur in close distribution proximity (other *Pseudomys*, *Melomys*, *Rattus*, *Leggadina*). There are numerous examples, and for *Pseudomys* three include: *P. patrius, P. desertor* and *P. delicatulus* at White Mountains National Park, Queensland (ASK unpubl. data); *P. delicatulus*, *P. gracilicaudatus* and *P. patrius* at Carnavon NP, south central Queensland (CE unpubl. data); and the same three species at Many Peaks, south-east Queensland (RJ unpubl. data). This zone of intergradation between inland and coastal environments is seemingly a favourable one for rodents, and potentially of high biological significance.

These eastern locality records for *P. hermannsburgensis* are significant in that they better elucidate the true distribution of a cryptic and irruptive species. This information also suggests that in areas of potential *P. delicatulus* and *P. hermannsburgensis* overlap care needs to be taken in species' identifications. Further investigation of distribution patterns and the ecological relationships between these closely related *Pseudomys* are warranted. In addition, the paucity of bioregional fauna surveys in Queensland dictates that much biodiversity planning is reliant on indicative lists and imprecise data. Though sometimes considered of little obvious scientific value, simple reporting of distribution data, particularly in atypical environments or those at the edge of their range, is therefore important. Furthermore we suggest that future identification of new locations and the distribution of native fauna in Queensland should be reliant on systematic on-going survey and monitoring, and not serendipity.

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References

Baverstock, P.R. 1982. Adaptations and evolution of the mammals of arid Australia. Pp. 175-178 in *Evolution of the Flora and Fauna of Arid Australia*, edited by W.R. Barker and P.J.M. Greenslade. Peacock Publications, South Australia.

Baverstock, P.R., Watts, C.H.S, Adams, M. and Cole, S.R. 1981. Genetic relationships among Australian rodents. Australian Journal of Zoology **28**: 553-574.

Braithwaite, R. and Covacevich, J. 1995. Delicate Mouse, *Pseudomys delicatulus*. Pp. 406 in The Mammals of Australia, edited by R. Strahan. Reed Books, Chatswood, New South Wales.

Breed, W.G. 1996. Evolution of the spermatozoa in Australian *Hydromyine* rodents. Abstracts of the 42nd Australian Mammal Society Scientific Meeting and Rodent Symposium, University of Melbourne.

Breed, W.G. and Aplin, K. 1995. Sperm morphology of murid rodents from New Guinea and the Solomon Islands: phylogenetic implications. *Australian Journal of Zoology* **43:** 17-30.

Brown, J. H. and Lomolino M. V. 1998. *Biogeography*. Sinauer Associates, Massachusetts.

Cole, J. R. and Woinarski, J. C. Z. in press. *A Field Guide to the Rodents and Dasyurids of the Northern Territory*. Surrey, Beatty and Sons, Chipping Norton, NSW.

Cooper, N. 1993. Identification of *Pseudomys chapmani*, *P. hermannsburgensis, P. delicatulus* and *Mus musculus* using footpad patterns. *The West Australian Naturalist* **19:** 69-73.

Covacevich, J. and Easton, A. 1974. *Rats and Mice in Queensland*. Queensland Museum Booklet No. 9. Queensland Museum, Brisbane.

Dick, R. and Andrew, D. 1993. *A Vertebrate Survey of the Culgoa and Birrie River Floodplains in New South Wales 1990-1992*. Occasional Paper No. 14. NSW NPWS, Hurstville.

Dickman, C. R. 1993. *The Biology and Management of native Rodents of the Arid Zone in NSW.* Species management Report No. 12. NSW National Parks and Wildlife Service, Hurstville NSW.

Dickman, C. R., Mahon, P. S., Masters, P., and Gibson, D. F. 1999. Long-term dynamics of rodent populations in arid Australia: the influence of rainfall. *Wildlife Research* **26:** 389-403.

Hannah, D. and Thurgate, N. 2001. Lands of strips and patches. *Wildlife Australia* **Autumn 2001:** 38-41.

How, R.A., Dell, J. and Cooper, N. 1991. Vertebrate fauna. Pp. 78-125 in *Ecological Survey of Abydos-Woodstock Reserve, Western Australia*. Records of the Western Australian Museum, Supplement 37.

Kutt, A.S 2003. The Spinifexbird *Eremiornis carteri* (North, 1900) in the Desert Uplands Bioregion, central-north Queensland: another isolate or nomadic metapopulation? *Australian Zoologist* **32:**246-51

Kutt, A.S. 2002b. New records of the Julia Creek Dunnart *Sminthopsis douglasi* in central-north Queensland. *Australian Zoologist* **32**:257-60

Kutt, A.S, Hannah, D.S. and Thurgate, N.Y. 2002. Distribution, habitat and conservation status of the Brigalow scaly-foot *Paradelma orientalis* (Gunther 1876). *Australian Zoologist* **32**:261-64

Lobert, B., Lumsden, L., Brunner, H., and Triggs, B. 2001. Assessment of the accuracy and reliability of hair identification of south-east Australian mammals. *Wildlife Research* **28**:637-641.

Morton, S. R., Brown, J. H., Kett, D. A. and Reid, J. R. W. 1994. Comparisons of community structure among small mammals of North American and Australian deserts. *Australian Journal of Zoology* **42:** 501-525.

Murray, B. R., Dickman, C. R., Watts, C. H. S. and Morton, S. R. 1999. The dietary ecology of Australian desert rodents. *Wildlife Research* **26**: 421-437.

Watts, C. H. S. and Aslin, H. J. 1981. *The Rodents of Australia*. Angus and Robertson Publishers, Sydney.